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BOUSSINGAULTITE FROM SOUTH MOUNTAIN, NEAR SANTA PAULA, CALIFORNIA¹

ESPER S. LARSEN AND EARL V. SHANNON

Washington, D. C.

OCCURRENCE.—A small sample of mineral sent to the U. S. Geological Survey for identification by Mr. Charles R. Fletcher of Los Angeles, Calif., proved on microscopic examination to be the rare mineral boussingaultite.² According to information kindly furnished by Mr. Fletcher it was found on South Mountain, on the south side of the Santa Clara River, opposite Santa Paula, Ventura County, Calif. On the southern slopes of the mountain are two large crevices in disturbed sandstone and chalky shale, from which heated gas emanates continually; in these the boussingaultite forms, as stalactites and incrustations, at the openings.

TABLE 1.

PROPERTIES OF BOUSSINGAULTITE FROM SOUTH MOUNTAIN, CALIF., AND OF
ARTIFICIAL BOUSSINGAULTITE.

	California	Tuscany ³	Artificial ⁴
Fusibility.....	1	—	1
Hardness.....	2	—	2+
Crystal system..	Monoclinic?	Monoclinic	Monoclinic
Crystal habit....	Fibers and crusts	Prismatic with (001) prominent	Nearly equant; (110) prominent
Optical character.	+	?	+
Dispersion.....	?	$\rho > v$ moderate	$\rho > v$ perceptible
Axial angle.....	moderate	$2E_D = 77^\circ 28'$	$2V = 50^\circ$ $2E(\text{calcd.}) = 76^\circ 50'$
α	1.470	—	1.469
β	1.472	"1.47369" (1.474)	1.470
γ	1.479	—	1.479
Optical orienta- tion	Extinction small to large	Y = b, Bx nearly parallel a.	Y = b, Z \wedge c = small

¹ Published by permission of the Director of the U. S. Geological Survey and the Secretary of the Smithsonian Institution.

² Usually regarded as $(\text{NH}_4)_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot 6\text{H}_2\text{O}$.

³ Data of Heusser.

⁴ Data determined by E. S. Larsen, heretofore unpublished.

PHYSICAL PROPERTIES.—The boussingaultite is pure white in color and is in curved columns or worm-like aggregates, in small crusts, or in stalactites. It has a hardness of about 2. Its optical properties agree closely with those of artificial boussingaultite, formed by crystallization from a solution of MgSO_4 and $(\text{NH}_4)_2\text{SO}_4$ in equal molecular proportions; see Table 1.

CHEMICAL PROPERTIES.—Only the best fibrous crystals were used for the analysis. These were white in color and were somewhat translucent with a faint silky luster. The mineral was found to be unaltered by drying in a desiccator or by exposure to an extremely moist atmosphere. It has a sharp astringent-saline taste and is easily and completely soluble in water. The material analyzed, after deduction of 1.94 per cent. of insoluble material, yielded the results given in column 2, Table 2. While the results are not entirely in accord with the theoretical composition usually assigned to boussingaultite, they agree better with the theoretical values than do those of any previous analysis. In table 2 the theoretical values are compared with available analyses of boussingaultite.

TABLE 2
ANALYSES OF BOUSSINGAULTITE

	1	2	3	4	5
$(\text{NH}_4)_2\text{O}$...	14.4	10.86	9.38	9.32	5.03
MgO	11.2	11.54	11.05	10.27	15.56
Al_2O_3		0.04			
Fe_2O_3		0.08			
K_2O		0.22			
Na_2O		0.60			
CaO		trace			
SO_3	44.4	43.49	44.39	44.30	38.86
H_2O	30.0	31.48	35.16	34.67	40.55
Cl		trace			
CO_2		trace			
	100.0	98.31	99.98	98.56	100.00

1. Theory for formula $(\text{NH}_4)_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot 6\text{H}_2\text{O}$.

2. From South Mountain, Calif.; analysis by Shannon. The amount of material available for analysis was so small that it was impossible to check the ammonia determination, which may be sufficiently low to account for the failure of the analysis to total 100 per cent.

3. Monte Cerboli, Tuscany, recrystallized; anal. by Popp (Dana).

4. Monte Cerboli, Tuscany, as obtained; anal. by Popp.

5. Geyser region, Sonoma Co., Calif., anal. by Goldsmith.

The persistent failure of all the analyses of boussingaultite thus far published to show even approximately the theoretical value for ammonia, and the fact that the ammonium oxide and water vary reciprocally strongly indicate that a part of the water is constitutional. The composition can then be explained by writing the formula $(\text{NH}_4, \text{H})_2\text{SO}_4 \cdot \text{MgSO}_4 \cdot 6\text{H}_2\text{O}$. This interpretation is supported by the rate of dehydration of the present material at various temperatures, the results being as follows:

15 hrs.	over H_2SO_4 26°C.	loss H_2O	0.08
3 "	at 80°C.		2.24
7 "	at 150°C.		25.53
	Above 150°C.		3.63
		Total water	31.48%

THE GOLDSCHMIDT TWO-CIRCLE METHOD. CALCULATIONS IN THE TETRAGONAL SYSTEM.

CHARLES PALACHE

Harvard University

The gnomonic projection of a tetragonal crystal is closely similar in type to that of the isometric system. There are, however, two main differences. One is that the poles of the form (101), 01 and 10, lie either within or without the circumference of the unit circle depending on the ratio $a : c$, which is never unity. The second is that since in this system the third index cannot be interchanged with the first two, no form has more than two face-poles in any one octant. Both of these have the same ρ , and complementary φ angles; hence a single pair of angles defines any form in the angle-table. Figure 25 shows a projection (based on the mineral vesuvianite) containing the face-poles of one each of the seven holohedral forms of the system. The position of a particular face in any octant may be indicated by its symbol (pq) with the proper signs or by the form letter written with exponents placed as in the figure.

CALCULATION OF AXIAL RATIO AND SYMBOLS FROM MEASURED ANGLES, φ AND ρ

From the figure, and as in the preceding system, we have the equations:

$$x = \sin \varphi \tan \rho = pp_0 \quad y = \cos \varphi \tan \rho = qp_0$$

for prisms,

$$\tan \varphi = \frac{x}{y} = \frac{p}{q}.$$

The various values of x and y calculated from the different faces thus yield multiples, integral or fractional, of the common value p_0 . p and q are generally determined graphically or by comparison of the various multiples of p_0 ; a series of values of p_0 is thus obtained from which an average value is derived. If there are n faces and $x_1y_1, x_2y_2, \dots, x_ny_n$ are the coördinates of each face, then:

$$p_0 = \frac{1}{2n} \left[\left(\frac{x_1}{p_1} + \frac{x_2}{p_2} + \dots + \frac{x_n}{p_n} \right) + \left(\frac{y_1}{q_1} + \frac{y_2}{q_2} + \dots + \frac{y_n}{q_n} \right) \right]$$

In the tetragonal system $p_0 = q_0 = c$.

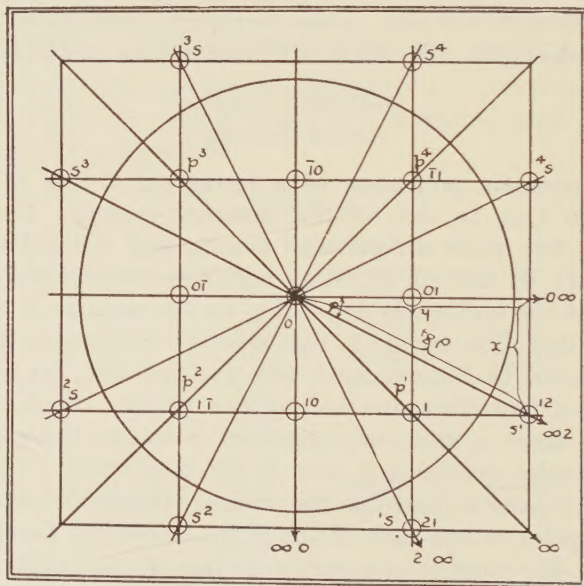


FIGURE 25. TETRAGONAL SYSTEM. VESUVIANITE.

CALCULATION OF ANGLES FROM SYMBOLS AND ELEMENT, p_0

For a face s^1 , the symbol of which is pq (see figure 25) we have from the equations of the preceding paragraph:

$$\tan \varphi = \frac{x}{y} = \frac{pp_0}{qp_0} = \frac{p}{q}.$$

$$\tan \rho = \sqrt{x^2 + y^2} = \sqrt{p^2 p_0^2 + q^2 p_0^2} = p_0 \sqrt{p^2 + q^2}.$$

These equations are closely similar to those for isometric crystals. The values of φ are independent of p_0 ; they may be found therefore from the table on page 25 of the Winkeltabellen, directly. The values of ρ differ only in requiring to be multiplied by p_0 . They may therefore be derived from the tables of page 22. For example, to find the angles of the face (121), 1 2, of vesuvianite, for which $p_0 = 0.5376$:

From table, page 25, $\varphi = 26^\circ 34'$

From table, page 22, $\tan \rho = p_0 \sqrt{1^2 + 2^2}$; $\log \cdot \tan \rho = \log p_0 + \log \sqrt{5}$.

$$\text{Log } p_0 = 9.73046$$

$$\text{Log } \sqrt{5} = 0.34948$$

$$\text{Log } \tan \rho = 0.07994 \quad \rho = 50^\circ 15'.$$

For an example of the complete calculation of a tetragonal crystal see V. Goldschmidt, Phosgenit von Monteponi, *Z. Kryst. Min.*, 21, 321, 1893.

TETRAGONAL SYSTEM. PHOSGENITE FROM TSUMEB, AMBO-LAND, SOUTHWEST AFRICA

Heidelberg and Toronto

V. GOLDSCHMIDT AND E. THOMSON

As far as we can ascertain, phosgenite has not been mentioned heretofore as coming from Tsumeb. On that account it would seem to be of interest to describe this occurrence briefly. The crystals used were obtained from the Heidelberger Mineralien Comptoir (Fr. Rodrian), Heidelberg, Germany. They are crystals of considerable size, smoke-brown in color, fresh, and with a brilliant luster. They show good basal cleavage. In appearance they are similar to those from Monteponi. Trapezohedral hemihedrism could not be established in the few crystals which were at our disposal. It seems likely, however, that among the cerussites and anglesites from Tsumeb many phosgenites lie hidden, and it is possible that more abundant material will bring out this hemihedrism.

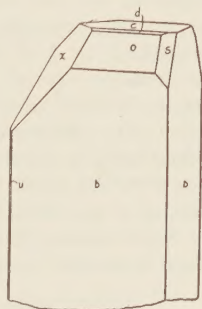
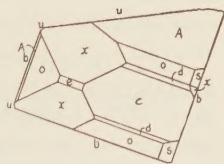


FIG. 26.

Two crystals were measured. These showed the forms $c = 0(001)$, $b = 0\infty(010)$, $u = \infty 2(120)$, $e = 01(011)$, $o = 02(021)$, $x = 1(111)$, $s = 12(121)$, $d = 0\frac{1}{3}(013)$, and $A^* = 04(041)$. The element was determined afresh. This determination, from nine faces, gave an average value for $p_0 = c = 1.0883$, which is in close agreement with that of the Monteponi crystals, which show $p_0 = c = 1.0889$.¹

Crystal 1 is represented in Fig. 26, as closely as possible in its natural development, in plan and perspective. The dimensions of this crystal are $10 \times 10 \times 45$ mm. Crystal 2 has the dimensions $5 \times 10 \times 15$ mm. Both crystals show the same combination of faces, as well as the same arrangement of the faces in the order of magnitude. The forms b , c , x , and o are the most prominent ones, while d and A are subordinate.

The form $A = 04(041)$ is a new form. It was found on crystal 1 and shows two faces on that crystal, which yielded the following angles:

	Symbol	ϕ	ρ
Measured.....	A	$\left\{ \begin{array}{l} 180^\circ 01' \\ 270^\circ 02' \end{array} \right.$	$\left\{ \begin{array}{l} 77^\circ 15' \\ 77^\circ 20' \end{array} \right.$
Calculated.....	A	$\left\{ \begin{array}{l} 180^\circ 00' \\ 270^\circ 00' \end{array} \right.$	$\left\{ \begin{array}{l} 77^\circ 06' \\ 77^\circ 06' \end{array} \right.$

The form is thus verified.

LISTS OF THE TETRAGONAL MINERALS INCLUDED IN GOLDSCHMIDT'S WINKELTABELLEN. EDGAR T. WHERRY. *Washington, D. C.*—The tetragonal minerals included in the Winkeltabellen are here arranged in the order of increasing value of $p_0 (= c)$. This arrangement may be useful for determinative purposes:—measurement of p_0 on an unknown crystal will enable it to be placed in a certain position in the series, and its identity with one of the minerals falling near that position can usually be readily established. In case the form taken as first order in measuring the unknown happens to have been taken as second order in calculating the angle-table, however, the value of p_0 obtained will have to be divided (or multiplied) by $\frac{1}{2}\sqrt{2}$ in order to place the unknown. For instance, suppose an unknown crystal, actually chalcopyrite, were measured in Dana's orientation, it would show $p_0 = 0.98 \pm$; search in the table would show near this value only edingtonite and arksutite, with neither of which the unknown would agree in physical features. On dividing the value obtained by 0.7071, however, the result would be $1.38 \pm$; and on looking at the corresponding portion of the table, chalcopyrite would soon be located.

Supplementary lists give the tetragonal minerals which have been found to show diminished symmetry.

¹ V. Goldschmidt. *Z. Kryst. Min.*, **21**, 327, 1893; **23**, 147, 1894; *Winkeltabellen*, 265, 1897.

TETRAGONAL MINERALS

	po = c	Page		Page
Tin (Zinn).....	0.3857	375	(Arksutite) [Chiolite]....	1.0150 54
Wernerite.....	0.4400	319	Romeite.....	1.0257 295
Melilite (Humboldttilith).....	0.4548	180	Chiolite.....	1.0418 94
Vesuvianite (Idokras).....	0.5376	187	Hauchecornite.....	1.0521 171
Gehlenite.....	0.5658	155	Pinnoite.....	1.0761 267
Mursinskite.....	0.5664	414	Phosgenite.....	1.0889 265
(Alvite) [= var. of zircon].....	0.6370	35	Hausmannite.....	1.1554 172
Zircon (Zirkon).....	0.6403	379	Apophyllite.....	1.2515 51
Thorite.....	0.6405	343	(Reinite) [a pseudom.]....	1.2790 294
Rutile.....	0.6442	307	Zeunerite.....	1.2880 371
Tapiolite.....	0.6464	338	Loeweite (Löweit).....	1.3040 223
Trippkeite.....	0.6477	351	Eosite.....	1.3778 128
Meliphanite			Chalcopyrite (Kupferkies).....	1.3933 206
(Melinophan).....	0.6584	237	Braunite.....	1.4032 78
Sellaite.....	0.6596	315	(Sipyilit) [= variety of	
(Belonesite) [Sellaite]....	0.6605	64	fergusonite].....	1.4500 319
Polianite.....	0.6647	269	Fergusonite.....	1.4641 144
Cassiterite (Zinnerz).....	0.6723	375	Torbernite (Kupferuranit).....	1.4691 209
Plattnerite.....	0.6764	417	Scheelite.....	1.5360 312
Ganomalite.....	0.7070	154	Powellite.....	1.5445 272
Mellite.....	0.7463	237	Stolzite.....	1.5606 329
Heldburgite.....	0.7500	173	Wulfenite.....	1.5774 368
Xenotime.....	0.8757	370	Calomel (Kalomel).....	1.7229 195
Sarcolite (Sarkolith).....	0.8872	311	Matlockite.....	1.7630 233
Edingtonite.....	0.9530	122	Octahedrite (Anatas).....	1.7771 39

REPRESENTATIVES OF CLASSES WITH DIMINISHED SYMMETRY

CLASS PYRAMIDAL

Wernerite.....	0.44
Sarcolite.....	0.89—
Pinnoite.....	1.08—
(Sipyilit).....	1.45
Fergusonite.....	1.46+
Scheelite.....	1.54—
Powellite.....	1.54+
Stolzite.....	1.56

CLASS PYRAMIDAL-HEMIMORPHIC

Wulfenite.....	1.58—
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CLASS TRAPEZOHEDRAL

Phosgenite.....	1.09
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CLASS SPHENOIDAL

Chalcopyrite.....	1.39+
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CLASS TETARTOHEDRAL

Meliphanite.....	0.66—
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ERRONEOUSLY CLASSED AS
TETRAGONAL

Edingtonite.....	Orthorhombic
Romeite.....	Isometric

NOTE ON THE BECKE REACTION

WILLIAM J. MCCAUGHEY

Ohio State University

The Becke reaction for comparing the index of refraction of a mineral and the material (oil, balsam, or other mineral host) in which it is imbedded, or with which the mineral is in contact, is familiar to most mineralogists.

To obtain this reaction the mineral (generally imbedded in an oil of known index of refraction) is sharply focused. Should the outline of the mineral be rather indefinite, due to the agreement in index of the mineral and the imbedding oil, the condensing lens is removed and the diaphragm in the substage is gradually closed. Upon changing the focus of the microscope by lifting the tube upward, the *Becke line* (a line of light) goes into the substance having the higher index of refraction. On depressing the tube of the microscope, the opposite reaction takes place, *i.e.*, the Becke line goes into the substance having the lower index.

In very finely divided minerals, such as clays, and in minerals which must be finely pulverized, such as the nearly opaque minerals and the fine-grained aggregates, it is difficult to see the Becke line. This line sweeps across a mineral grain, which is quite small in diameter, and then out on the opposite side. It is very difficult in this case to see whether the Becke line went in before it came out, or whether it only came out. In the study of very fine mineral grains, this is always bothersome. In such cases it will be found much easier to use the following reaction:

If the mineral has a higher index than the oil, and the tube of the microscope is raised, a very tiny mineral grain becomes brightly illuminated thruout. If now the tube of the microscope is lowered, the grain becomes dark, or even black. Should the mineral have a lower index of refraction than the oil, when the tube of the microscope is elevated, the tiny grain becomes dark or black directly. This darkening of the mineral grain is easily seen in the grains of a size around 0.005 mm. and is an easy reaction to follow. In larger grains only the edges become dark. This reaction has proven useful in the study of mineral inclusions and of fine grained minerals such as occur in clays. It seems to be quite as sensitive as the Becke reaction is with larger grains.

PROCEEDINGS OF SOCIETIES

PHILADELPHIA MINERALOGICAL SOCIETY

Wagner Free Institute of Science, May 12, 1920

A joint meeting of the Philadelphia Mineralogical Society and the Wagner Free Institute of Science was held upon the above date upon the occasion of the closing exercises of the Institute. Sixteen members of the Society were present.

Dr. Clarence N. Fenner of the Geophysical Laboratory of the Carnegie Institution of Washington addressed the meeting on "Katmai Volcano and the Valley of Ten Thousand Smokes." The 1919 expedition of the National Geographic Society, in which members of the Geophysical Laboratory participated, was described. Details were given of the fumarolic activity in the Valley of Ten Thousand Smokes. The lecture was illustrated with numerous finely colored lantern slides.

A business meeting of the Society was then held in its meeting room. Mr. Johnson reported a trip to the French Creek mines. Mr. Trudell reported a trip of the society to Moore and Lambertville, N. J., good stilbite being found at the former locality. Mr. Gordon exhibited actinolite crystals in tale from Pleasant Grove, Lancaster County.

SAMUEL G. GORDON, *Secretary*.

NOTES AND NEWS

It gives us great pleasure to announce that on June 14th Syracuse University conferred the honorary degree of Doctor of Science upon Professor Edward H. Kraus, President of the Mineralogical Society of America.

Civil service examinations are announced for August 10, 1920, for the positions of Curator and Assistant Curator of the Division of Mineral Technology, U. S. National Museum, paying \$2400 and \$1800 per year, respectively. Anyone interested in applying for these positions should write at once to the U. S. Civil Service Commission, Washington, D. C., for the necessary blanks and information.

We have also heard of openings for a young man trained in petrography, and having a fair knowledge of chemistry, to carry on research work in a government laboratory; and for teachers of mineralogy and related subjects in several Universities. Anyone interested is invited to write to the editor for details.

Word has been received from Vienna that Professor G. Tschermak, the eminent mineralogist, who is now over 80 years old, is in need of assistance in the way of food. This can be best sent in the form of food-orders, the money being paid in this country, and the food being distributed from the American warehouses in Vienna, to those holding orders. Should any of our readers feel able to help out in this most worthy cause, they may send a few dollars to the Treasurer of this magazine and we will see that the food-orders for the total amount received reach Professor Tschermak.

NEW MINERALS

Brostenite.

V. C. BUTUREANU: The ores of manganese and iron of the crystalline massif of Brosteni, Roumania. *Bull. soc. franc. min.*, **40**, 164-177, 1917.

Alteration products of ferriferous rhodochrosite, called "ponite," with the general formula $RO \cdot xMnO_2 \cdot yH_2O$ are termed **brostenite**, after the locality. [Such mixtures do not deserve names.—Abstr.] E. T. W.

HYDROCLINOHUMITE

F. ZAMBONINI: The true nature of the "titanolivine" from the Ala Valley, Piedmont. *Bull. soc. franc. min.*, **42**, 250-279, 1919.

Crystallographic study has shown the so-called titanolivine to be actually a variety of clinohumite. Analysis proves it to be remarkable in containing, in addition to 1.92 per cent of titanium oxide, 1.30 per cent beryllium oxide, and hydroxyl in place of all but a trace of the usual fluorine. The varietal name *titanhydroclinohumite* is therefore proposed for it. C. B. SLAWSON

[The above name would have been still more imposing if a few more syllables to show the presence of the beryllium had been tacked in somewhere. The replacement of the fluorine by hydroxyl being, however, the only really significant feature, the preferable form is: **hydroclinohumite**. E. T. W.]

TRECHMANNITE—ALPHA

R. H. SOLLY: A new mineral, isomorphous with trechmannite, from the Binn Valley, Switzerland. *Min. Mag.*, **18**, 363-366, 1919.

NAME: trechmannite- α , as its isomorphism with trechmannite is its only established feature.

CRYSTALLOGRAPHIC PROPERTIES: System, hexagonal; class, trigonal rhombohedral. Twenty one forms were observed as follows: (0001), (0110), (1450), (1430), (1210), (0115), (0112), (0221), (0111), (0441), (1431), (2681), (1231), (2641), (1213), (1.13.14.6), (5352), (3142), (4153), (7186), (1562).

PHYSICAL PROPERTIES: Cleavage, basal and rhombohedral. Color, lead-gray. Streak, chocolate.

CHEMICAL PROPERTIES: The amount of material was insufficient for a chemical analysis.

OCCURRENCE: Three small rounded crystals, grown upon a prismatic crystal of sartorite. W. F. HUNT.

UNNAMED MINERAL

R. H. SOLLY: A lead-gray, fibrous mineral from the Binn valley, Switzerland. Chemical analysis by G. T. PRIOR. *Min. Mag.*, **18**, 360-363, 1919.

Fine needles of lead gray color were noted, which partially covered seligmannite and baumhauerite, or formed a lattice structure in the cavities of dolomite. From the chemical analysis it appears to have the composition of rathite, $3 PbS \cdot 2 As_2S_3$; but the interfacial angles (measurements were made only in the prism zone) agree more closely with those of dufrenoyite. The presence of a small amount of thallium (0.23%) is of interest. W. F. HUNT.

ABSTRACTS—CRYSTALLOGRAPHY

A STUDENTS' GONIOMETER. G. F. HERBERT SMITH. *Mineral. Mag.*, **18**, 366-368, 1919.

A goniometer of moderate cost designed for students of elementary crystallography. The direction of reference is given by the reflection of a distant object in a small plane mirror without optical aid and the axis of the graduated circle is horizontal. The instrument was constructed by Messrs. J. H. Steward, Ltd., 406 Strand, London, W. C. 2.

W. F. H.

CRYSTALLOGRAPHIC STUDIES OF NICKEL DICHROMATE WITH ETHYLENEDIAMINE. GUISEPPINA CHIAVARINA. Univ. Torino. *Riv. min. crist. Ital.*, **48**, 82-85, 1917.

The formula is $\text{NiCr}_2\text{O}_7 \cdot 3\text{C}_2\text{H}_4(\text{NH}_2)_2$. The crystallization is monoclinic.

E. T. W.

A STUDY OF THE DEHYDRATION FIGURES ON THE SURFACES OF CRYSTALS. CHRISTOPHE GAUDEFRY. *Bull. soc. franc. min.*, **42**, 284-380, 1919.

Dehydration figures obtained upon crystals of 50 salts were studied. These figures fall into 3 classes, those whose form is dependent upon the structure of: (1) the original salt; (2) the salt formed by the dehydration; and (3) neither of these; the last comprise elliptical figures without definite orientation.

C. B. SLAWSON.

CONTRIBUTIONS TO OUR KNOWLEDGE OF BOLÉITE AND CUMENGITE. ASSAR HADDING. *Geol. Fören. Förh.*, **41**, 175-193, 1919.

The anomalies in boléite can best be explained by variation in composition between the central and outer portions. The outer portions pass into cumengite. Boléite then is a mixed crystal. The n for boléite 2.081; for cumengite $\omega = 2.040$, $\epsilon = 1.926$. The Laue diagram for boléite shows it to be isometric.

W. F. FOSHAG.

CRYSTAL STRUCTURE OF PYROCHROITE. G. AMINOFF. Stockholm. *Geol. Fören. Förh.*, **41**, 407-433, 1919.

Pyrochroite is ditrigonal scalenohedral. The Laue diagrams show nearly hexagonal symmetry, for in almost all cases the points are present in the plus as well as the minus sextants. The hexagonal elementary parallelepiped has the dimensions $c = 4.68 \times 10^{-8}$ cm., $a = 3.34 \times 10^{-8}$ cm. Preliminary tests show brucite to be similar to pyrochroite, except that the difference in intensity of some of the points is greater in brucite. $c = 4.75 \times 10^{-8}$ cm., $a = 3.13 \times 10^{-8}$ cm. Natural pseudomorphs of pyrochroite, artificial pseudomorphs of brucite, and crystals of both subjected to pressure give instead of the point diagram, a ray diagram of the same symmetry.

W. F. FOSHAG.

THE LINEAR FORCE OF GROWING CRYSTALS. (ABSTRACT). J. C. HOSTETTER. *J. Wash. Acad. Sci.*, **7**, 195-196, 1917.

Experiments with loaded crystals of potassium alum show that these crystals will lift their load if unloaded crystals are present in the same solution. Two hypotheses as to the nature and cause of this force are offered but owing to experimental difficulties no conclusion could be definitely arrived at.

C. B. S., W. F. H.

PLOTTING OF CRYSTAL ZONES ON A SPHERE. JOHN M. BLAKE.
Am. J. Sci., [4] **43**, 237-242, 1917.

The crystal zones are plotted upon a 30-cm. sphere and [the unknown elements are obtained graphically with the aid of a gnomonic projection. In many cases, especially when founded on uncertain measurements, the more difficult algebraic solutions are no more accurate than those obtained by graphical methods.

C. B. S., W. F. H.

EFFECT OF SURFACE TENSION ON CRYSTALLINE FORM.
CECIL H. DESCH. Royal Techn. Coll., Glasgow. *Chem. Met. Eng.*, **21** (15), 773-776, 1919; abstract reprinted by permission from *Chem. Abstr.* **14** (4), 372, 1920.

According to the hypothesis of Quincke, metals and other substances before solidifying from the liquid state separate into 2 immiscible liquids, one much smaller in amount than the other. These liquids exhibit surface tension and form a foam, the one in smaller amount constituting the cell-walls, the other the cell-fillings. The cell walls should be represented in the solid mass by the boundaries of the crystal grains; and if the original hypothesis is correct, the grains in a solid metal should approximate in shape the cells in a foam. From the principles determining the stability of foam structures, especially the number of films which meet in a point and the most favorable angles, it would be predicted that this is essentially a tetrakaidecahedron; this is a cubo-octahedron, with all the edges equal, 6 of the faces squares, and 8 regular hexagons. To possess minimum area, the faces of this would be concave, bounded by nearly circular arcs of $19^{\circ}28'$. By examn. of a foam obtained by blowing air thru a liquid, it was found that actually 5-sided faces were by far the most frequent, 4 and 6 about equal, but much less frequent, and other numbers of rare occurrence; the form of the cells thus most often approaches that of the regular pentagonal dodecahedron, (also with curved edges) a form the angles of which do not deviate greatly from the theoretically most favorable ones. If the hypothesis were wrong, and crystn. were not affected by surface tension, the crystals should form around equidistant nuclei, and the dominant forms of the crystals be either rhombic dodecahedrons, if the packing were cubic, or the quadrilateral-faced dodecahedrons of hexagonal packing. To test the matter out, β -brass containing some aluminium was treated with mercury whereupon the grains separated and their faces could be counted. Their average shape agreed almost exactly with that of the foam described above, confirming the correctness of the original hypothesis. Near boundaries both foam and metal—in this case an ingot of crucible steel—showed as would be predicted more 6-sided faces. An attempt was made to approach the matter also from the cross-sections of the polyhedrons concerned, but this did not give satisfactory results.

Evidently 2 forces are competing in the formation of crystals, cohesion—the force of crystallization—and surface tension. Which of these is dominant depends on many factors, such as the nature of the substance, compn. of the mother liquor, dimensions of the mass, temp., etc. When the mass is small, the surface forces are most important. Metals with marked power of orientation tend to form interlocking grains. Ice, as in glaciers, is a good example of the latter relation.

E. T. W.

CRYSTAL INVESTIGATION OF BRANDTITE. G. AMINOFF. Stockholm. *Geol. Fören. Förh.*, **41**, 161-174, 1919.

Monoclinic. $a : b : c = 0.8720 : 1 : 0.4475$; β $99^\circ 37'$ $p_0 = 0.5132$, $q_0 = 0.4412$, $e = 0.1669$.

No.	Letter	Gdt.	Miller	φ	ρ
1	A	0∞	010	$0^\circ 00'$	$90^\circ 00'$
2	C	$\infty 0$	100	$90^\circ 00'$	"
3	η	2∞	210	$66^\circ 44'$	"
4	δ	$3/2\infty$	320	$60^\circ 11'$	"
5	φ	∞	110	$49^\circ 19'$	"
6	ν	$\infty 3/2$	230	$37^\circ 47'$	"
7	ζ	$\infty 2$	120	$30^\circ 11'$	"
8	P	$+1/2$	212	$72^\circ 02'$	$35^\circ 57'$
9	S	$+1$	111	$57^\circ 01'$	$39^\circ 26'$
10	Q	$+12$	121	$37^\circ 37'$	$48^\circ 29'$
11	R	-1	111	$38^\circ 07'$	$29^\circ 38'$

Twinning: Twinning plane 100. Cleavage 010, good. Optical properties: Plane of the optic axes (010), sign +, extinction angle 8° , $\alpha = 1.707$, $\gamma = 1.729$.

W. F. FOSHAG

THE ROLE OF CRYSTAL WATER AND THE STRUCTURE OF THE ALUMS. ANSWER TO VEGARD. CLEMENS SCHAEFER and MARTHA SCHUBERT. *Ann. Physik*, **59**, 583-588, 1919. A continuation of acrimonious discussion.

E. T. W.

APPLICATIONS OF THE POLARIZING MICROSCOPE IN CERAMICS. ALBERT B. PECK. Bur. Standards. *J. Am. Ceramic Soc.*, **2** (9), 695-707, 1919.

An outline of the methods of identifying minerals, especially those met with in ceramic work, by the immersion method under the microscope. The great advantages of this method of study are pointed out, and the needs of the industry for trained petrographers are shown.

E. T. W.

THE OPTICAL PROPERTIES OF CERTAIN STRUCTURES OF ANISOTROPIC LIQUIDS. F. GRANDJEAN. *Bull. soc. franc. min.*, **42** (1), 42-86, 1919.

The author has studied the images obtained and developed the mathematical equations for six structures.

C. B. S.

ABSTRACTS—MINERALOGY

NEW MINERAL NAMES. W. E. FORD. Yale Univ. *Am. J. Sci.*, [4], **47**, 446-448, 1919.

A list of 8 newly described minerals, with brief descriptions. All have been listed in the new minerals department of this magazine.

E. T. W.

BULLETINS ARIZ. STATE BUR. MINES. 1916 to date. A series of educational bulletins containing information of a general nature and much concerning specific Arizona localities. The first bulletins listed below are concerned with descriptions, occurrences, and uses of various minerals. The titles of the others are self-explanatory. By F. L. CULIN, JR.: Bulletins **14**, magnesite; **16**, mica; **18**, vanadium minerals; **19**, gypsum; **35**, celestite and

strontianite. By P. E. JOSEPH: 4, manganese; 5, molybdenum; 8, asbestos; 12, mercury; 20, zinc; 22 antimony; 37, copper; 43, iron; 45, lead; 49, aluminum, platinum, tin, cadmium, nickel, cobalt, arsenic, and bismuth. By A. C. RUBEL: 11, tungsten. By M. A. ALLEN and G. M. BUTLER: 91, manganese; 99, barite. *Bull.* 3, Directory of Arizona minerals. 23, Bibliography-Mining, Geology, Mineralogy of Arizona. 41, Mineralogy of useful Arizona minerals. Blowpipe tests, discussion of physical properties in general, and list of 100 minerals with individual descriptions, tests, occurrences and uses. 48, Gems and Precious Stones. Descriptions and essential properties. 71, Select blowpipe and acid tests for minerals. 93, Field tests for common metals in minerals.

L. S. RAMSDELL, W. F. H.

FELDSPAR IN CANADA. HUGH S. DE SCHMID. *Canada, Mines Branch*, No. 401, 1916.

A large number of analyses of Canadian feldspars are given.

C. B. S., W. F. H.

A CONTRIBUTION TO THE ANALYSIS OF THE NATURAL SILICATES. LOUIS DUPARC. *Bull. soc. franc. min.*, 42, (4), 140-241, 1919.

A detailed description of methods. A new constant is introduced which is termed the *coefficient of attackability*, the amount of material that is dissolved by HCl under certain specified conditions.

C. B. S.

THE INDICES OF REFRACTION OF THE RHOMBOHEDRAL CARBONATES. P. GAUBERT. *Bull. soc. franc. min.*, 42 (2), 88-120, 1919.

The observed values of the refractive indices of isomorphous mixtures of these carbonates agree closely with those calculated from their chemical composition by the formulas of Mallard. The following method for distinguishing magnesite from the other carbonates is given: The powdered sample is heated to a red heat and a drop of cobalt nitrate solution is added after cooling. A bluish green halo immediately develops around particles of all carbonates except magnesite.

C. B. S.

AN OCCURRENCE OF CELESTITE. A. DUFFOUR. *Bull. soc. franc. min.*, 42 (4), 246-248, 1919.

These small celestite crystals were found enclosed in siliceous geodes in fossiliferous beds. When they were silicified these crystals were enclosed in siliceous concretions, which have protected them from the leaching which has removed all other traces of celestite.

C. B. S.

THE MICROCHEMICAL DISTINCTION OF SERICITE AND TALC. O. HACKL. *Verh. geol. Reichsanst. Wien*, 1918, 1; thru *J. Chem. Soc.*

Directions are given for distinguishing these minerals by microchemical tests for K and Al in the former and Mg in the latter.

E.T.W.

MINERAL SYNTHESSES. C. DOELTER. *Naturwissenschaft*, 6, 285-290, 1918; thru *Chem. Zentr.* 1918, II, 144.

A summary of the principles and aims of mineral synthesis, with special reference to precious stones. It is reported that talc and meerschaum have been produced successfully in aqueous media at relatively low temperatures.

E.T.W.